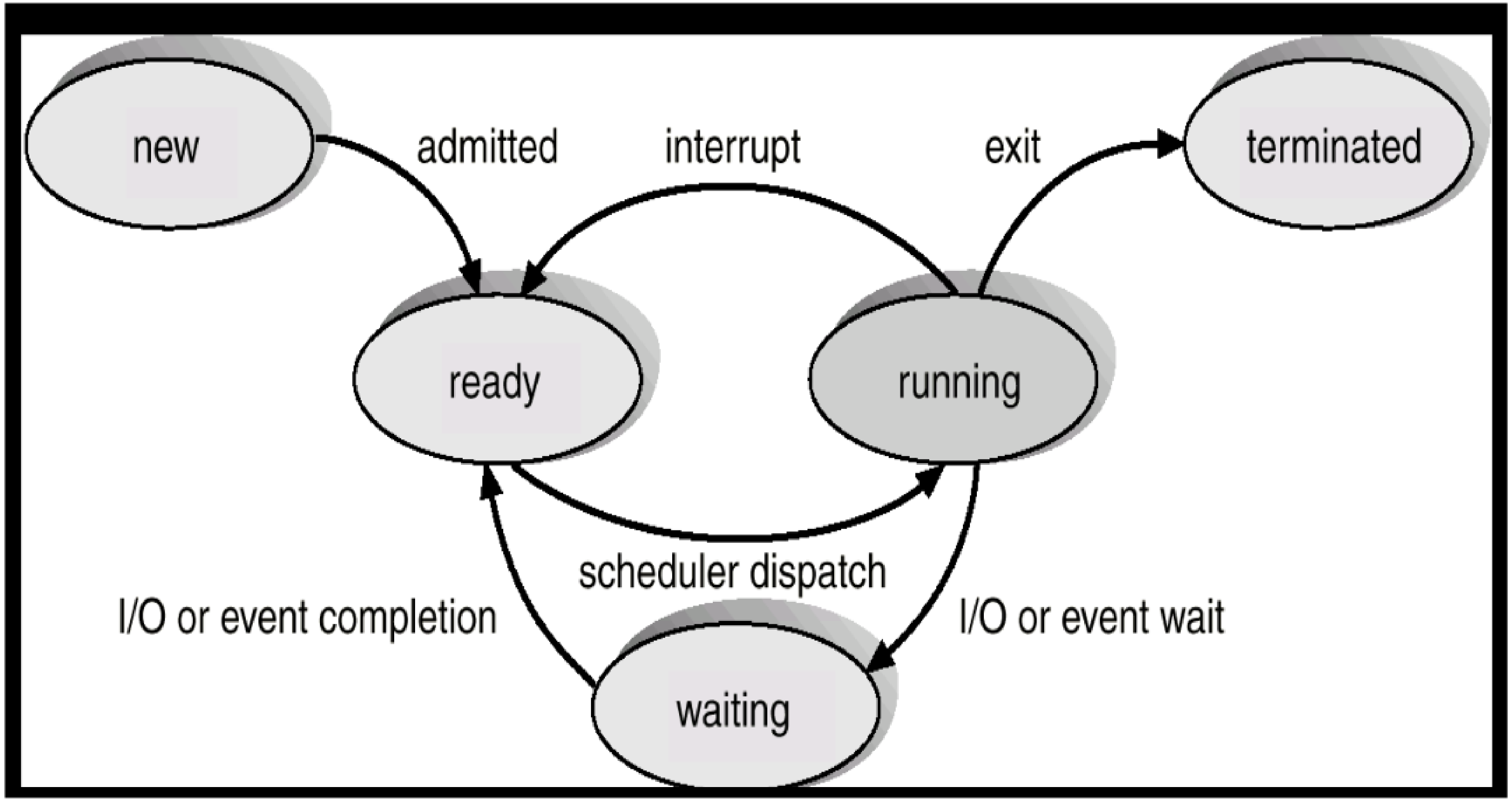
Operating System Review

FUNCTIONS OF AN OPERATING SYSTEM

- Memory Management
- Resource Management
- I/O Management
- File Management
- User Management
- Task Management

Process Management

Diagram of Process State



Scheduling Algorithms

- Shortest Job First/ Priority – process which has the shortest CPU burst time/ with highest priority is executed first.
- First Come First Serve – first process in the queue is executed first
- Round Robin – each process in the queue is given a specific time to use the CPU (quantum time). If that time has elapsed the process will go back to the queue if its task is not yet finished

Scheduling Terms

- Turnaround Time (TAT) – is defined as the total time interval between the time of process submission and the time of its completion.
- CT (Completion Time) – Completion time is the exact time when a process finishes the execution.
- AT (Arrival Time) – Arrival time is called as the time of arrival of a process before the state of preparedness (before its execution).

TAT = CT – AT

- Waiting Time (WT) – is defined as the total time that is spent by the process while staying in a ready queue before it reaches the CPU.
- BT (Burst Time) – Burst time is the total time that is required by a process for its overall execution.

WT = TAT – BT

Seatwork

1. Consider the processes P1, P2, P3, P4, given in the below table, arrives for execution in the order P4, P1, P2, P3, with **Arrival Time** 0, and given **Burst Time**, let's find the average waiting time using the FCFS scheduling algorithm and draw the FCFS scheduling chart.

PROCESS	BURST TIME
P1	18
P2	20
P3	14
P4	8

Seatwork

2. Consider the below processes available in the ready queue for execution, with **arrival time** as 0 for all and given **burst times**. Draw the SJF scheduling chart and compute the average waiting time of the above table.

PROCESS	BURST TIME
P1	10
P2	6
P3	8
P4	5

Seatwork

3. Consider the below processes available in the ready queue for execution, with given **arrival times** and **burst times**. Draw the SRTF scheduling chart and compute the average waiting time of the above table.

PROCESS	ARRIVAL TIME	BURST TIME
P1	0	10
P2	2	6
P3	4	8
P4	6	4

Seatwork

4. Consider the below table for processes with their respective CPU burst times and the priorities. Draw the priority scheduling chart and compute the average waiting time of the above table.

PROCESS	PRIORITY	BURST TIME
P1	3	15
P2	1	6
P3	4	8
P4	2	7

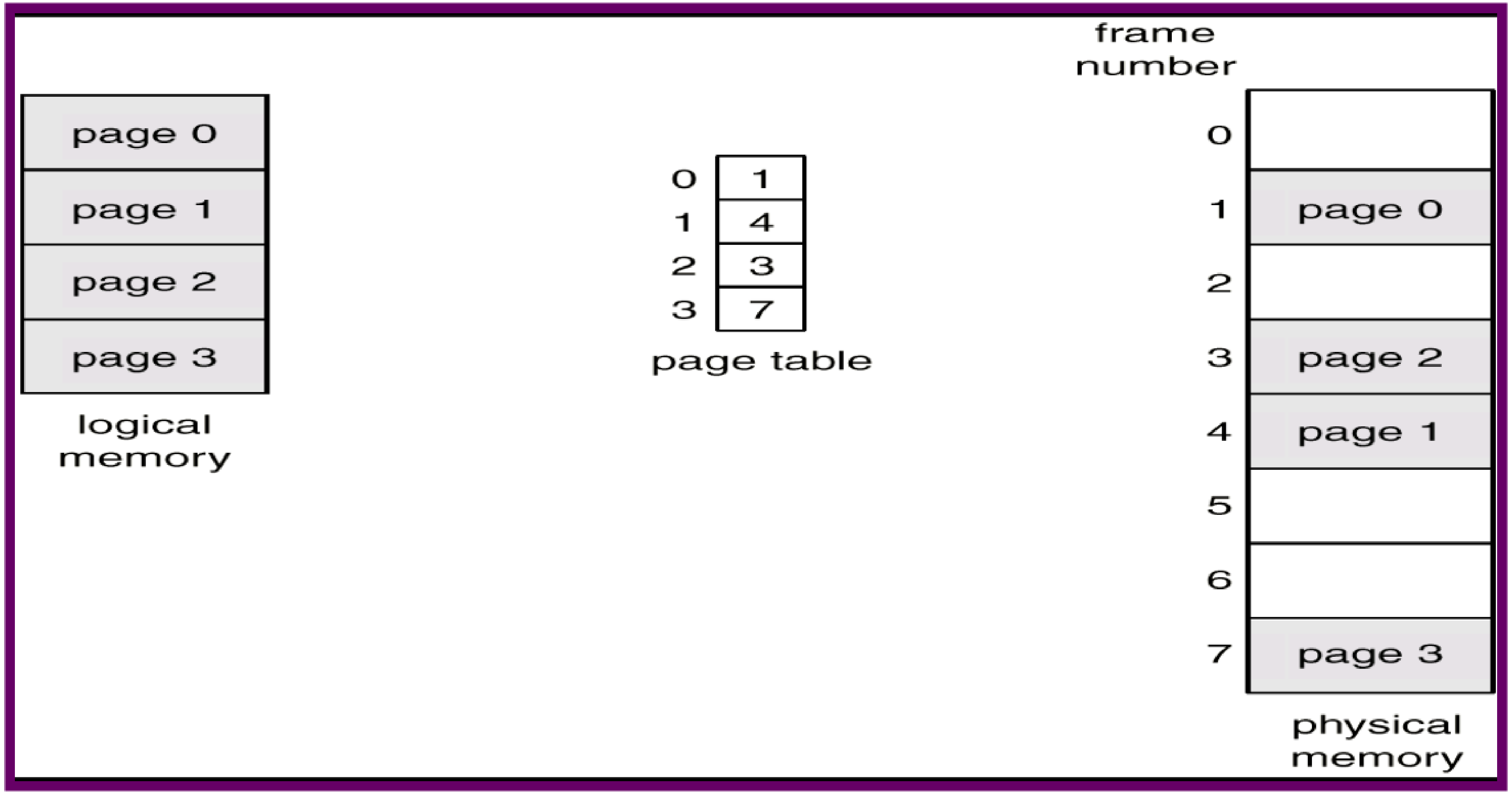
Seatwork

5. Considering the below table, using the Round-Robin algorithm with time quantum = 5, draw the Gantt chart and compute the average waiting time.

PROCESS	BURST TIME
P1	30
P2	15
P3	23
P4	12

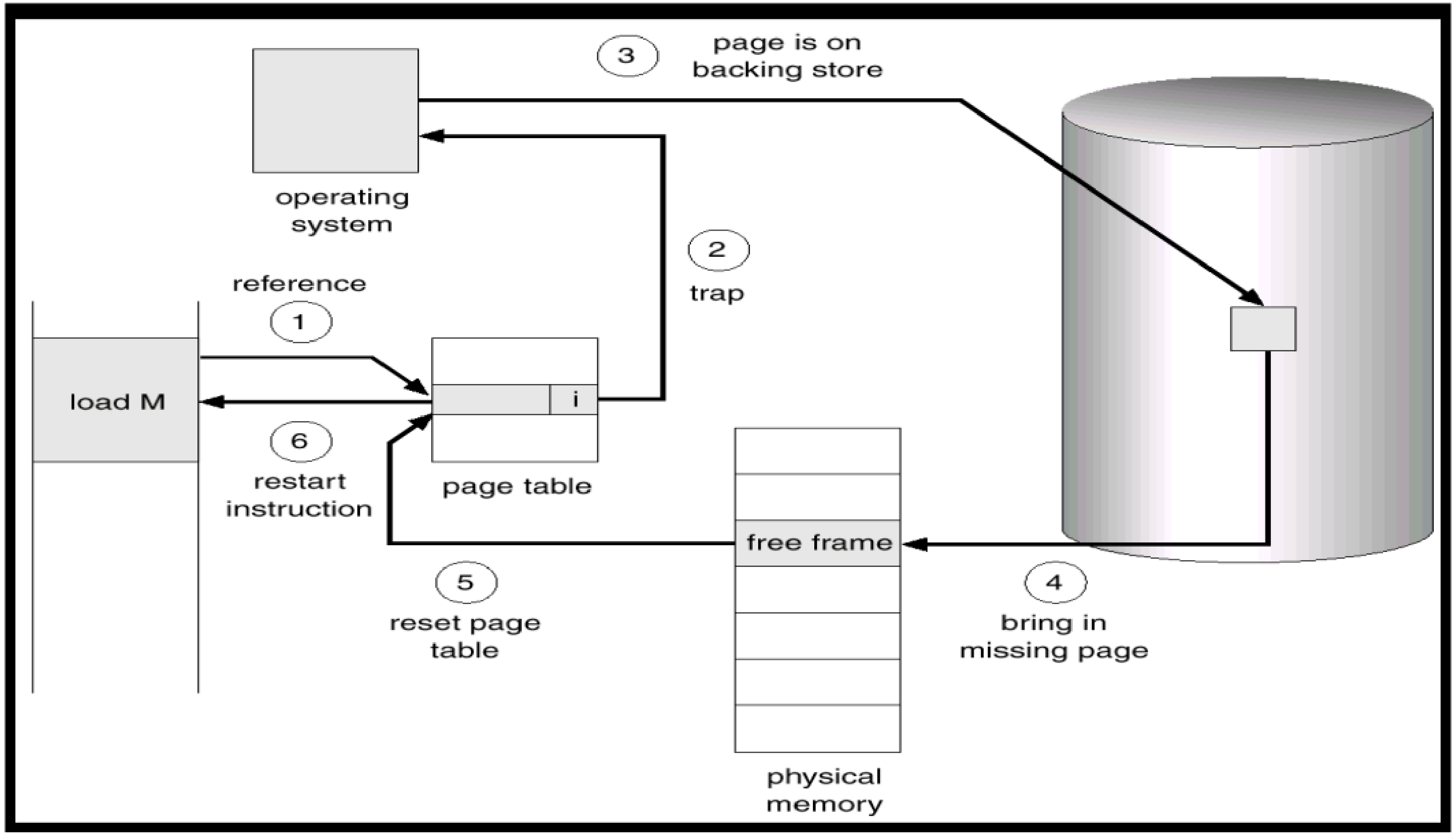
Memory Management

PAGING



Memory Management

Page Fault – occurs when there is a reference to a page but is not yet in memory.



In the virtual memory of a paging system, when a page that does not exist in main memory is accessed, which of the following shows the appropriate order of processes and states? Here, there is no empty page frame available in main memory.

a) Decision of the page for replacement -> Page fault -> Page-out -> Page-in
b) Decision of the page for replacement -> Page-in -> Page fault -> Page-out
c) Page fault -> Decision of the page for replacement -> Page-in -> Page-out
d) Page fault -> Decision of the page for replacement -> Page-out -> Page-in

Memory Management

Page Replacement Algorithms – replace a page if the number of frames is not enough.

1. Least Recently Used – Replace the page that has not been used for the longest period of time.
2. First In First Out – the page that was the first to be stored among the pages is the one being replaced

Example

The FIFO method is used as the page-replacing algorithm in virtual memory. There are 3 frames available for a program in main memory, and the page numbers referred to by a program are 4 → 3 → 2 →1 → 3 → 5 → 2 in this order. How many times does page replacement occur during execution of the program? Here, nothing is loaded into main memory in the initial state.

a) 2 b) 3 c) 5 d) 6

Seatwork

6. There are 4 page frames available in real memory. How many page faults occur during execution of this process using the FIFO and LRU page replacement algorithms separately? Here, all page frames are empty at the beginning of the process.

Page Reference: 2→3→6→4→6→3→1→2→4→6

	FIFO	LRU
a)	2	4
b)	4	2
c)	6	8
d)	8	6

Seatwork

7. What is the size of a frame, in KB, if the size of the physical memory is 512KB and a process has a size of 64KB is divided into 4pages.

Seatwork

8. Given the references to the following pages by a program:
0 9 0 1 8 1 8 7 8 7 1 2 8 2 7 8 2 3 8 3

How many page faults will occur if the main memory has three frames and uses LRU replacement?

Memory Access Time

$$t = tch + tm(1-h)$$

Where:

h = hit ratio, is the probability that the portion of a program necessary to execute that program is in the cache memory

tc = time it takes to access the cache

tm = time it takes to access the main memory

Seatwork

9. There are two systems A and B whose access times of cache and main memory are shown in the table. When a certain program runs on these systems, the cache hit ratio and the effective access time are the same on both systems. What is the cache hit ratio in this case?

Unit: nsec.

	System A	System B
Cache memory	15	10
Main memory	50	70

Seatwork

10. A system has a main memory access time of 60 nanoseconds (ns) and a cache memory access time of 10 ns. When the effective access time for accessing the main memory is 15 ns, what is the hit ratio of the cache memory?